GUIDELINES AND RECOMMENDATIONS FOR THE USE OF DIGITAL IMAGING TECHNOLOGIES FOR LONG-TERM GOVERNMENT RECORDS IN IDAHO

INTRODUCTION

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Public officials in Idaho are responsible by law for ensuring that their records are protected and accessible. This responsibility applies regardless of the records storage media. These guidelines are for use by all Idaho public officials in the design of responsible digital imaging systems that may be used for creating or maintaining long-term or archival records.

These guidelines are advisory in character and are not intended to serve as a rigid set of requirements. National technical standards, established practices, and research in the professional literature form the basis for these guidelines. These guidelines are designed to identify critical issues for public officials to consider in designing, selecting, implementing, and operating digital imaging technologies. These issues are especially important for systems used for mission critical records or for long-term or archival records.

Stated briefly, digital imaging is defined as the ability to capture, store, retrieve, display, process, and communicate or disseminate records electronically using a variety of hardware and software components. Digital imaging technology continues to change at a rapid pace, but with the proper planning and design, an agency can significantly improve its business operations without endangering business processes through technology obsolescence.

The potential benefits of digital imaging systems can best be achieved through an agency planning process. This process examines the information needs and records requirements of the agency as a whole rather than a single, isolated application. The recommendations for this set of guidelines are listed in order of their implementation.

GUIDELINES

PROJECT PLANNING

Recommendation 1: Prior to selecting a digital imaging system, conduct a records and workflow analysis to determine and document existing and planned agency information needs.

The examination of existing workflow patterns and records is the crucial first step in determining the need for a digital imaging system. A records analysis assesses existing operations to determine what records are best suited for digital imaging applications. A workflow analysis assesses the processes of records creation, access, and retrieval to determine areas where re-engineering can improve operational efficiency. This reorganization of business or work processes may be simple or extensive in approach. Implementing a digital imaging system significantly impacts the current work processes because personnel create, retrieve, use, and store documents in a different way. The detail and complexity of the process re-engineering affects the project schedule, cost justification, and Request for Bid (RFB) requirements.

The State Archivist can assist in analyzing an agency's record keeping systems.

Recommendation 2: Prior to selecting a digital imaging system, conduct a cost benefit analysis to determine the cost justification of a system purchase and to determine the possible benefits to the agency with its implementation.

Cost justifying a digital imaging system allows a financial comparison between the current and proposed record keeping systems to help in making a procurement decision. The cost-justification goal of a digital imaging system is to offset the cost of the equipment and software by reducing personnel and storage costs or allowing the existing staff to process more work through the improvement of work processes. To determine a cost estimate, the following components should be considered: system hardware, system software, application software, communications hardware and software, system maintenance, training, project management, facilities upgrades/site preparation, staffing costs, and other miscellaneous costs. A typical cost justification includes the following major areas: a study of current operations, a proposed system architecture, equipment pricing, and financial indicators, including payback period, net present value, and rate of return.

SYSTEM SPECIFICATIONS AND SELECTION

Recommendation 3: Require an open systems architecture for digital imaging applications or require vendors to provide a bridge to systems with non-proprietary configurations.

Although the term open systems architecture is defined in various ways, public officials in Idaho should follow a system design approach that permits future component upgrades with minimal degradation of system functions. This open system architecture allows the system to be upgraded over time without a significant risk of records loss. It also supports the importing and exporting of digital images to and from other sources. One key factor in achieving an open systems architecture is the adoption of non-proprietary standards. The flexibility of an open systems architecture helps enable long-term records to be accessed and transferred from one hardware or software platform to another.

Recommendation 4: Where data longevity or records integrity is a primary concern use a recording media that is not re-writable.

The storage capacity of optical disks versus paper is a primary advantage to the use of digital imaging systems. However, optical disks are not the only option. Other storage solutions that can be used with digital imaging systems include output to microfiche or microfilm, digital tape, and magnetic disks. The selection of a storage media may depend on budget considerations for the agency.

When selecting optical storage media, the issues of data longevity and integrity must be considered. There are a variety of optical disks on the market today: Write Once Read Many (WORM), Re-writable, and Compact Disk-Read Only Memory (CD-ROM)/ Compact Disk-Recordable (CD-R). Each has its own advantages and disadvantages. WORM and CD-R are not re-writable. Computer Output to Laser Disk (COLD) is also a non-rewritable option. These media offer a high level of data security because alteration of data is not achievable without destruction of the media itself. If a record is no longer needed, software may allow the pointer to the data to be disabled, preventing normal access. Because the data cannot truly be deleted, however, it may remain accessible by other means.

Recommendation 5: Use a non-proprietary digital image file format. If using a proprietary format, provide a bridge to a non-proprietary digital image file format.

A digital image file format is a structured container for information about each digital image and the image data. Information about the digital image file includes, but is not limited to, its name, width, length, resolution, and compression techniques. The computer requires this information to interpret the digital image. It is essential to use a non-proprietary image file format to ensure the ability to transfer successfully digital images between different systems or when a system is upgraded or modified.

American National Standards Institute (ANSI)/Association for Information and Image Management (AIIM) **MS53-1993**, ***Standard Recommended Practice - File Format for Storage and Exchange of Images - Bi-Level Image File Format: Part I*** details a standard definition for file formats. Despite the existence of a standard, there is not an agreed-upon, industry-wide image format standard. Many digital imaging systems use the Tagged Image File Format, or TIFF. Because different versions of TIFF exist (TIFF-5, TIFF-4, etc.), there is still no absolute guarantee that images can be transported seamlessly from one system to another. Comprehensive documentation of the digital image file format, including TIFF, is recommended. A number of other file formats exist, such as Graphics Interchange Format (GIF), Joint Photographic Experts Group (JPEG), and Bitmap (BMP). These file formats are commonly used in conjunction with hypertext markup language (HTML) for Internet and intranet applications. Many systems or third-party graphics packages will convert images from one to another, although often with unpredictable results.

Recommendation 6: Use International Telecommunications Union (ITU) Group 3 and Group 4 compression techniques or have the vendor provide a bridge to these techniques.

The large file sizes of typical scanned documents require digital image compression to support data transmission and to promote storage efficiency. Today most digital imaging systems use standard compression algorithms to "shrink" images. Standard compression techniques are instrumental in ensuring a migration strategy for records needed for long-term use. Two international standards are currently available. Using compression techniques conforming to either of these specifications will increase the likelihood that the images can be used with other technologies or migrated between systems.

Recommendation 7: When determining document scanning resolution, consider data storage requirements, document scanning throughput rates, and the accurate reproduction of the image. Validate vendor claims using a sampling of the agency's documents.

A digitized image consists of black and white dots or picture elements (pixels) measured in dots per inch (dpi). The higher the number of dpi, the higher the legibility of the reproduced image. Images scanned at higher dpi rates, however, use more storage space on the disk and may require longer scanning times. The selection of scanning density involves a trade-off between image clarity, storage capacity, and speed. When selecting a scanner, ask the vendor to perform a quality test on a broad sampling of documents at various dpi settings so that an appropriate end-to-end throughput rate and resolution can be determined.

For good quality images in scanning modern office records, use a scanning density of at least 400 dpi. A higher scanning density (600 dpi or higher) is appropriate for deteriorating documents, and documents with a visual element such as, engineering drawings, maps, or documents with background detail. The display resolution of the inspection/verification monitor and printer should match the scanning density of the document scanner. When scanning continuous tone images, such as photographs, maps, and illustrations, use gray scale or color imaging technology.

Recommendation 8: Select equipment that conforms to the standard methodology for media error detection and correction. The system should provide techniques for monitoring and reporting verification of the records stored on a digital optical disk, and the system administrator should actively follow the status of the monitors.

Digital imaging technology uses two methods within the Error Detection and Correction (EDAC) system to minimize digital image recording and retrieval errors. The first method uses error correction codes to detect and correct data read errors automatically. The second employs correction code software to determine if and when the utilization of error correction codes is approaching a critical point. Monitoring the error correction status information provides an audit trail to measure the progress and degree of disk degradation. Tracking error correction trends will indicate an appropriate timetable for recopying disks.

The Association for Information and Image Management's (AIIM) Standards Committee has developed a standardized methodology for reporting the error rate data to the operating system for user evaluations. **ANSI/AIIM MS 59-1996**, ***Media Error Monitoring and Reporting Techniques for Verification of Stored Data on Optical Digital Data Disks*****,** describes these standards.

Another precaution against losing long-term records because of defective disks is to require the use of digital optical disks with a guaranteed minimum shelf life of five years and a minimum post-write life of twenty years.

Recommendation 9: Specify that the Small Computer System Interface (SCSI) command "Write and Verify" is used when writing data to digital optical disks.

The "Write and Verify" command, available within the Small Computer System Interface (SCSI), is valuable for assessing how accurately the scanned information is transferred from the central processing unit of the computer to the digital optical disk. "Write and Verify" requires verification from the system that the digital image is correctly written to the disk and provides additional protection for continued access to long-term records.

Recommendation 10: Use an indexing data base that provides for efficient retrieval, ease of use, and up-to-date information about the digital images stored in the system. The indexing data base should be selected after an analysis of agency operations and user needs.

Reliable access to scanned images depends on an accurate, up-to-date index data base. Indexing a digital image involves linking descriptive image information with header file information. Normally, index data is manually key-entered using the original documents or the scanned images, either at the time of image capture or later in the production process. Index data verification, in which data base entries are compared with the original source documents for completeness and accuracy, is crucial because an erroneous index term may result in the inability to retrieve related images.

Recommendation 11: Provide specific plans for an ongoing process of migrating long-term and archival records from older to newer hardware and software platforms.

Agencies must ensure that their long-term and archival records are continually accessible. Systems as physical devices could be operational for ten years or more, but system technology will often be superseded within two to three years. If the system stores records with retention periods exceeding the life span of the hardware and software, it is essential that the administrator plan for future data migration. A migration strategy documents how an organization will transfer long-term and archival records from one generation of hardware and software to another generation without losing system functionality. The strategy should be written and available with current system documentation.

Current strategies for migrating digital imaging system records include: upgrading equipment and software as technology evolves and periodically recopying disks as required; recopying optical disks based upon projected longevity and/or periodic verification of the records; or, transferring the data from an obsolete generation of optical disks to a newly-emerging technology, in some cases bypassing the intermediate generation that is mature but at risk of becoming obsolete.

SYSTEM IMPLEMENTATION

Recommendation 12: Assign a permanent staff member as systems administrator and require the vendor to provide a project director during the installation and training periods.

The assignment of a qualified staff member, preferably with systems administration experience, is critical to the effective implementation and maintenance of a digital imaging system. The systems administrator should be responsible for overall project management, and the development and maintenance of written system documentation which describes the requirements, capabilities, limitations, design, operation, and maintenance of the digital imaging system. Making a vendor representative responsible for installing the equipment and training the systems administrator and other appropriate agency staff will help to ensure successful implementation of the system.

Recommendation 13: Establish operational practices and provide technical and administrative documentation to ensure the future usability of the system, continued access to long-term records, and a sound foundation for assuring the system's legal integrity.

It is the responsibility of office administrators, rather than vendors and manufacturers, to maintain written documentation of system procedures, also called Standard Operating Procedures or SOPs, including access and security policies and procedures. Security and access policies should be developed to protect the system and the records from alteration or unauthorized use.

In regard to legal admissibility and trustworthiness, records stored on a digital imaging system should be treated no differently than records stored on magnetic disk or tape. The key is for the systems administrator to become familiar with how the rules of evidence apply to such records. Procedural controls should be established and followed to protect the integrity of the records.

These procedural controls should be documented and should reflect requirements for the legal acceptance of records as outlined in **AIIM TR31-1992**, ***Performance Guideline for the Admissibility of Records Produced By Information Technology Systems as Evidence***. This AIIM performance guideline stresses the importance of specifying the processes used to create the records, demonstrating that records are produced and relied upon in the regular course of business, establishing quality control and audit procedures, conducting formal training programs, and providing

written documentation for each procedure. Case histories indicate that system requirements for good archival maintenance are consistent with the requirements for the admission of records under the "rules of evidence" laws. Records administrators should be familiar with how the rules of evidence apply to Idaho's public records. Policies and procedures should be followed to protect the integrity of long-term records.

Recommendation 14: ***Perform a visual quality control evaluation of each scanned image and related index data. Write the scanned image to optical media only after the evaluation process is completed.***

To help ensure the integrity of long-term and archival records stored on the system, staff members should perform a visual quality evaluation of each index entry and scanned image before writing the digital image to optical media. Overall system quality control is best when the scanned image is temporarily stored on magnetic media, permitting corrections through re-scans as needed. Depending on the system configuration, corrections may be performed at the scanner capture station or at designated inspection/rescan workstations. Training and supervision of the operations staff is a key factor in maintaining acceptable image and index quality as well as user satisfaction with the system.

When the system is operational, a routine scanning quality test, as outlined in ***ANSI/AIIM MS44-1988 (R1993), Recommended Practice for Quality Control of Image Scanners***, should be performed on a weekly or monthly basis.

Recommendation 15: Design backup procedures to create security copies of digitized images and their related index records.

System component reliability is critical to system success. Prolonged or repetitive downtime can seriously affect office operations. Creating a duplicate copy of records in another format or another system is an effective method of ensuring access to long-term information. Backup copies also support system integrity and legal admissibility requirements. The government office may select the backup storage media (optical, magnetic, paper, or microform) that best meets the office's records requirements. Security copies of the records should be stored in an offsite, environmentally controlled location.

Recommendation 16: Provide adequate environmental conditions for the digital optical disks.

Even in an optimum environment, digital optical disks are susceptible to deterioration. Adverse storage conditions, especially high humidity, can cause rapid deterioration of the media. A prudent storage guideline for digital optical disks is to adhere to the temperature and humidity levels recommended for magnetic media storage. Technical specialists recommend a stable environment, with a temperature between 65 and 75 degrees, and a relative humidity between 30 and 50 percent. Digital optical disks should never be stored in direct sunlight nor placed near sources of heat.

Digital optical disks are affected by dust, debris, and fingerprints. Plastic cartridges should never be removed; nor should the cartridge shutter be opened to expose the digital optical disk's recording surface. To protect disks from warping, they should not be subject to pressure and should be stored in an upright position when not in the disk drive.

Agency officials should request that the vendor supply specifications for the storage of digital optical disks and ensure that office conditions meet these specifications during installation of a system.

Recommendation 17: Budget annually between fifteen and twenty per cent of the original system acquisition cost for upgrades, training, and maintenance.

Administrative managers should be aware of the high cost of maintaining and upgrading digital imaging systems. Unless these costs are factored into the continuing support of system maintenance and improvement, the system is in danger of becoming obsolete and requiring a far greater cost outlay to restore its effectiveness. Also, records stored in an outdated system tend to be at greater risk than those in a well- supported system. Continued planning and budgeting for the migration of long-term and archival records, as discussed in Recommendation 11, is essential for the success of any digital imaging project.

IF YOU NEED ASSISTANCE

The State Archives staff of the Idaho State Historical Society provides assistance to state and local government agencies regarding the records administration considerations affecting the design and implementation of digital imaging systems.

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